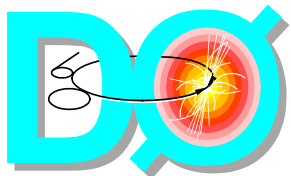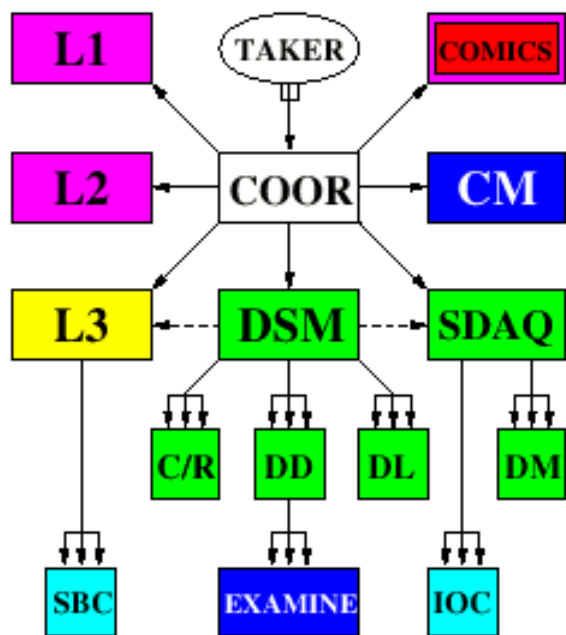# DAQ Back End Tutorial

- ## The players
  - ### Control and data flow diagrams
  - ### Brief description of each application

- ## Configuration and log files

- ## Starting and stopping applications

- ## Monitoring
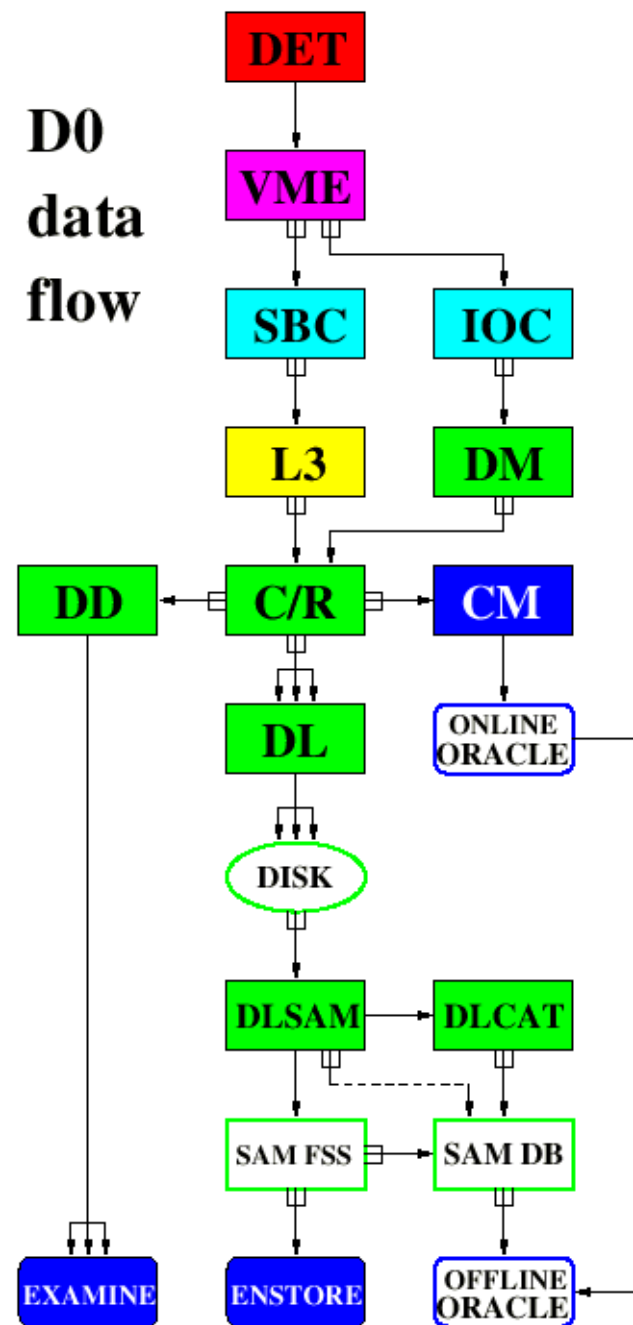 - ### Status web page
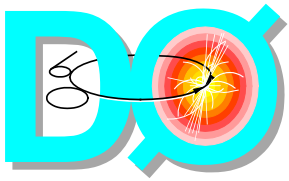
- ## How to reach the experts

- ## Summary

D0 control flow

D0 data flow

This tutorial is about the green guys
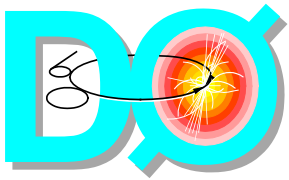
C/R and DD

- ## C/R = Collector/Router

  - ### Receives events from L3 nodes and SDAQ DMs
  - ### Routes an event according to the event's <u>stream(s)</u>:
    - Forwards calibration events to the CM
    - Forwards normal events to their DL(s) and as many as possible to the DD as well
    - Events w/o valid streams are dropped (with a warning)
      - Log file contains their event header dumps
      - Recently observed probability $O(10^{-4})$, clustered in a few spikes

- ## DD = (Data) Distributor

  - ### Receives events from the C/R(s)
  - ### Serves them to connected Examines according to each Examine's stream and trigger wish lists

---

- **DL = DataLogger**
  - **Receives events from C/R(s)**
  - **Saves them in files based on stream, run and partition ("{stream}_{run}_{partition}.raw"):**
    - Each covers an integral number of luminosity blocks
    - Each has an associated event catalog file
    - Late events go to partition 000
    - Events that arrive after their run has ended are dropped (with a warning)
      - **Log file contains their event header dumps**
      - **Recently observed probability $O(10^{-6})$, clustered in a few spikes**
  - **Is told by DLSAM when to move to the next disk**
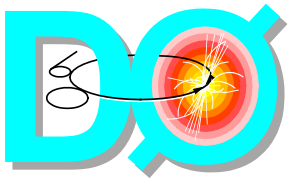
DLSAM and DLCAT
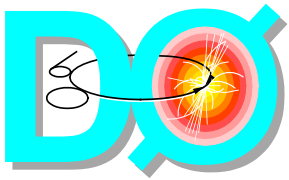
- ## DLSAM = DL-SAM interface
  - ### Tells DL when to move to the next buffer disk
    - When occupancy or time limit is reached
    - Currently 2 TB available (30 disks)
      - **Enough for 2 days of continuous (!) data taking at 12.5 MB/s**
  - ### Uses SAM FSS to transfer completed files to Enstore
    - Checks PNFS before deleting any file
    - Lets DLCAT fix meta-data missing in the SAM DB
      - **When the FSS lost its connection to the DB server**

- ## DLCAT = DL (event) Cataloguer
  - ### Checks and fixes meta-data missing in SAM DB
  - ### Stores and checks event catalogs in SAM DB
    - SAM DB (Oracle) will detect duplicate events, if any
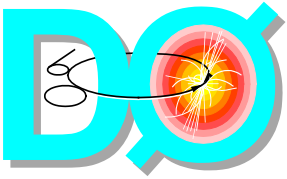
The DSM

- **DSM = Data** (Flow) **State Manager**
  - **Controls all CR, DD and DL instances ("slaves") on behalf of COOR**
    - DD is non-vital → its replies are ignored
    - Puts any restarted "slave" into current DAQ state
  - **Instructs CRs to which DL or CM to route a stream**
  - **Balances load over DLs**
    - Currently there is only 1 DL
  - **Supplies L3 and SDAQ Supervisors with weighted list of CRs**
    - 3 CRs are being used for ~80 L3 nodes
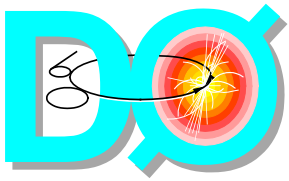
SDAQ and DM

- **SDAQ = Secondary DAQ Supervisor**
  - **Controls IOC processes ("crates") participating in SDAQ runs (calibration, monitoring, tests)**
  - **Starts and controls corresponding DM processes**

- **DM = DataMerger**
  - **Receives SDAQ event fragments from IOC processes, merges them into complete events and sends those to a CR**
  - **Receives calibration and/or monitoring summaries from IOC processes and sends them to a CR, which will forward them to the CM**
    - Currently this is the main use of the SDAQ
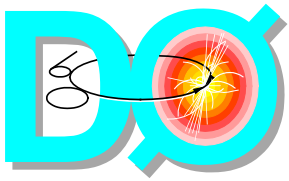
Configuration and Logs

- **/online/data/d0online/d0online_names.py**
  - **Shows on which host(s) an application runs**
- **/online/data/datapath/$host/$app.setup**
  - **Configuration file for application $app on $host**
    - $app can be collector, datalogger, distributor, dlcat, dlsam, dsm, sdaq
- **/online/log/$app/$year/$month**
  - **Holds formatted logfiles**
- **/online/log/$app**
 - **Holds stdout/stderr files (out.* and stop.*)**

Starting and Stopping

- ## Start an application
  - setup d0online
  - start_daq $app

- ## Stop an application
  - ### First stop <u>all</u> ongoing runs!
    - **Not needed for DLCAT (nor DLSAM, but see below)**
  - setup d0online
  - stop_daq $app
  - ### DLSAM must run when the DL is recording a run
    - It instructs the DL when to move to the next disk
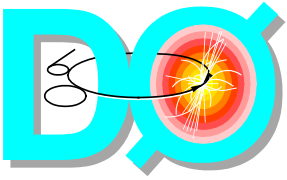
Monitoring

- **Back end status web page**
  - **http://www-d0online.fnal.gov/www/daq/ operations/status/onlstatus-auto.html**
  - **Updated every minute**
  - **Frequently checked by the experts**
  - **Usually sufficient to verify the status or to discover problems**
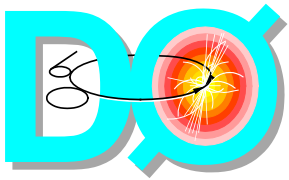
Example Status Page Top

Here the DSM reports everything being OK for the ongoing run:

D0 online status - May 16, 2003, 15:37:49

Application:	CR			DD	DL	DLCAT	DLSAM	DM	DSM	SDAQ
Warnings:	0	0	0	1	0	0	0	0	0	0
Alarms:	0	0	0	0	0	0	0	0	0	0

Current DSM status dump and snapshot: (/online: **89%** full, **4132128** kB free)

```
05/16 15:37:19 request: COOR 00000000000001826 QUERY RUN
05/16 15:37:19  --> sent to program 'datalogger' on host localhost
05/16 15:37:19 DL localhost    reply: 00000000000001826 ok 176986 22552 49.7022
05/16 15:37:19
05/16 15:37:19 my reply: 00000000000001826 ok 176986 22552 49.702200
05/16 15:37:34 request: COOR 00000000000001827 QUERY RUN
05/16 15:37:34  --> sent to program 'datalogger' on host localhost
05/16 15:37:34 DL localhost    reply: 00000000000001827 ok 176986 23268 49.7156
05/16 15:37:34
05/16 15:37:34 my reply: 00000000000001827 ok 176986 23268 49.715600
```

Current DLSAM status dump and snapshot: (15 files submitted, 0 files queued, 57 files open | pending)

```
Current    Files:    18      Total   Buffers:    27
Queued     Files:     0      Timeout Buffers:     1
Submitted  Files:    15      High    Buffers:     0
Transfered Files:     0      Full    Buffers:     0
Done       Files:     1
Alarm      Files:     0      (Fri May 16 15:37:35 2003)
```
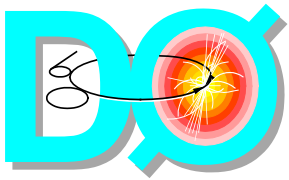
Warnings
& Alarms

Buffer disk subdirectory contents.

DLSAM file state numbers are approximate.

Example Status Page Bottom

Here DLCAT is busy storing 1 event catalog, 3 others are waiting to be checked against the DB, and 2 have just arrived:

```
Last known transfers:        ( DLCAT: 2 in stage, 0 in meta-check, 1 in store, 3 in cat-check, 0 in cleanup )


05/16 16:35:20 all_0000176986_004.raw --> /pnfs/sam/dzero/db2/datalogger/run176000/datalogger/all/all
05/16 16:35:36 all_0000176986_003.raw --> /pnfs/sam/dzero/db2/datalogger/run176000/datalogger/all/all
05/16 16:36:10 all_0000176986_005.raw --> /pnfs/sam/dzero/db2/datalogger/run176000/datalogger/all/all
05/16 16:36:43 all_0000176985_096.raw --> /pnfs/sam/dzero/db2/datalogger/run176000/datalogger/all/all
05/16 16:37:16 all_0000176986_006.raw --> /pnfs/sam/dzero/db2/datalogger/run176000/datalogger/all/all
05/16 16:37:16 all_0000176986_007.raw --> /pnfs/sam/dzero/db2/datalogger/run176000/datalogger/all/all
05/16 16:39:09 all_0000176986_008.raw --> /pnfs/sam/dzero/db2/datalogger/run176000/datalogger/all/all
05/16 16:39:09 all_0000176986_009.raw --> /pnfs/sam/dzero/db2/datalogger/run176000/datalogger/all/all
05/16 16:39:42 all_0000176986_010.raw --> /pnfs/sam/dzero/db2/datalogger/run176000/datalogger/all/all
05/16 16:39:42 all_0000176986_011.raw --> /pnfs/sam/dzero/db2/datalogger/run176000/datalogger/all/all

Last N files to Enstore + SAM:  10  100  1k  2k
Sorted on run, stream, partition:  10  100  1k  2k
```
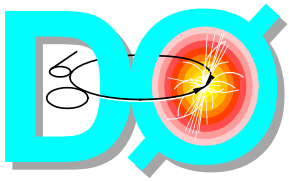
| Application:	CR			DD	DL	DLCAT	DLSAM	DM	DSM	SDAQ
Snapshot:	d0ol31	d0ol41	d0ol42	d0ol34	d0olc	d0olc	d0olc	d0olc	d0olc	d0olc
Episode:	d0ol31	d0ol41	d0ol42	d0ol34	d0olc	d0olc	d0olc	d0olc	d0olc	d0olc

Trouble shooting instructions   Expert FAQ

Statistics for the last N files transferred.
The last 100 and 1000+ lines of an application's log file.
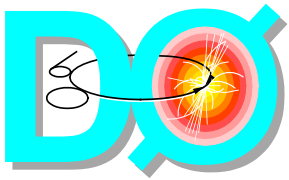**Trouble shooting hints.**

DSM Status Snapshot

- **Usually shows messages pertaining to the most recent COOR commands**
  - **Click on the DSM log file snapshot or episode link to see more details**

- **Shows if the DSM is "ok" or "bad"**
  - **DSM is "ok" when all its required "slaves" are "ok"**
    - The DD is not required
  - **Click on the DSM status dump link to see more details**
    - Compare the lists of required and connected slaves
    - Absent/misbehaving slaves can be (stopped and) restarted
   - **First stop all ongoing runs**
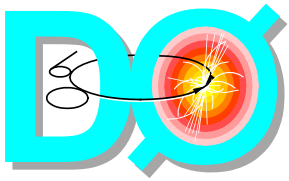
DLSAM Status Snapshot

- **Shows status of buffer disks and files to be transferred**
  - **"timeout" → DL should move to another disk**

- **Symptoms of SAM or Enstore problems:**
  - **Files staying "Queued" or "Submitted" > 1 hour**
    - DLSAM may recover automatically
    - Stopping and restarting DLSAM rarely helps
      - **The same applies to DLCAT**
  - **Files in "Alarm" state**
    - Expert intervention needed

How to reach the experts

- **The ODS D0 Online Support group has a primary:**
    - Send e-mail to helpdesk@fnal.gov
    - Call the HelpDesk at x2345, or the Computing Services Operators at x2746 after hours, when the problem is <u>urgent</u>
  - **In all cases mention the application that has problems (e.g. "dsm") and its host ("d0olc" will do)**
    - The HelpDesk/Operator needs that information to figure out whom to contact/page

- **Questions and comments about the DAQ Back End can be sent to:**
  - **d0online-support@fnal.gov**
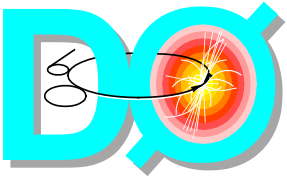
Summary

- **The D0 DAQ back end is an integrated system comprising:**
  - **CR, DD, DL, DLCAT, DLSAM, DM, DSM, SDAQ**
    - Their interactions/dependencies are not trivial
    - Contact the experts for configuration changes

- **DAQ shifters can stop and (re)start the applications**
  - **Following guidelines e.g. found in this tutorial**
  - **Please inform the experts of any problems**

- **The status web page is handy for monitoring and trouble shooting**